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all accepted the invitation of the International Research Council to take part in this common enterprise.

The International Research Council has initiated the formation of unions for the conduct of scientific work. In the subjects of astronomy, geodesy and geophysics, and chemistry such unions are actually at work, and two others have been formed. Once an international union is established it becomes autonomous, and conducts its work without interference from the International Research Council except in a few matters in which a common policy is desirable.

Every one knows that the decisions of an international conference are only advisory, and have no binding force on the separate countries. Representatives taking part in the conference report to the home authorities concerned, who act as they think fit, accepting, no doubt, in general such recommendations as have secured practical unanimity. At a recent meeting in Brussels certain countries desired to initiate the formation of an International Union of Biology, and their representatives tentatively drew up some statutes. These were submitted to a competent body in this country, which reported unfavorably, and there the matter ends so far as Great Britain is concerned. This does not, of course, prevent France, Italy, the United States, and other countries from forming a Union of Biology if they wish. I fail to understand where the grievance of the *Times* comes in.—Arthur Schuster, General Secretary of the International Research Council, in *Nature*.

SCIENTIFIC BOOKS

THE TERRESTRIAL LIFE ASSOCIATED WITH THE COALS OF NORTHERN FRANCE

In a large, very detailed, and well-illustrated memoir published by the French Ministry of Public Works,¹ Dr. Pierre Pruvost of the Uni-

versity of Lille Museum, has given us the most extensive work so far published on the fresh-water and land invertebrates of the Coal Measures of northern France, that is, of the Westphalian, the equivalent of our Pottsville and Allegheny series. The memoir is based on the "documents preserved in the museum of the University of Lille . . . which never could have been brought together without the cooperation of the mining engineers and the scientific men who are exploiting the basin of the north," and its object is so to define the faunal zones as to give to these same mining men fixed points from which they can reckon the stratigraphic position of their coals.

From the 17 species heretofore known in the fauna, the number is now increased to 116, 54 of which are new. They represent the following classes: 13 bivalves, 1 tubiculous annelid, 6 ostracods, 5 phyllopods (3 new), 3 Malacostraca, 2 Syncarida, 53 specifically determined insects (43 new), 1 eurypterid, 3 limulids, 7 spiders (3 new), 4 sharks, 6 crossopterygians (2 new), and 12 ganoids (3 new). These forms are found in 6,970 feet of Westphalian strata, divided into 5 formations and 9 members, most of which are of fresh-water origin, since it is only in the lower 2,350 feet that there is occasional evidence of the sea, this being most decided near the base.

The common fossils with limited ranges and therefore of value in correlating the various horizons are shown to be (1) the bivalves (*Carbonicola*, *Anthracomya*, *Naiadites*), (2) the phyllopods (*Estheria*, *Leaia*), and (3) the scales and teeth of fishes. The ostracods *Carbonia* and *Cypridina* and the annelid *Spirorbis* are all long-ranging, while the insects, even though they are of very short range—in fact, but very few forms extend through more than one zone—occur too rarely to be useful in detailed stratigraphy, other than of a local basin. It is interesting to note that the fresh-water life has in its time duration about the same zoning value as the plants, and that both classes of organic evidence lead to the making of the same general time divisions. With these results attained, the author then paral-

¹ "Introduction à l'Étude du Terrain Houiller du Nord et du Pas-de-Calais. La Faune Continentale du Terrain Houiller du Nord de la France. Mémoires pour servir à l'explication de la carte géologique détaillée de la France," pp. 584 (quarto), 29 pls., 51 text figs., Paris, 1919.

lels the different coal beds of northern France with those of Belgium and England.

The greater part of the volume is taken up with the insects (pp. 93-321), and the author confirms Handlirsch's conclusion that during Westphalian time hexapods were large, in fact, that as a rule they were "giants." Pruvost thinks that the Westphalian insects were not all carnivorous, but that some may have fed on the pollen, etc., of plants like the cordaites and cycadophytes; in other words, that the rise of the insect world was largely conditioned by the development of inflorescence among plants.

Insect impressions, to be preserved in the rocks, must be entombed in the very finest of sediments. The author states that they are found only in shales, in association with delicate plant remains, and with those of animals as well. The very best ones, of rare occurrence, have, however, suffered no appreciable transport or maceration, but were buried quickly along with the most fragile plants in the softest of muds; while the majority of the specimens found commonly in the "insect beds" have undergone more or less long periods of floating, and consequent maceration and dissociation. The floated specimens occur at times with stronger plant fragments and the remains of animals, all in varying degrees of decomposition.

Pruvost breaks up Handlirsch's order Protorthoptera, and puts the majority of his families in a new suborder, the Archiblattids (3 species described), which are present as early as the base of the Westphalian. These are "the simplest and oldest of Protoblattoidea" and they may have had their origin in the Paleodictyoptera, the original source-stock of all insects. Two other suborders of Protoblattids are erected, Mimoblattids (for American forms) and Archimantids (1 described). The author remarks on "the homogeneity and antiquity of the blattid phylum," describing 43 forms, and on its early separation from the rest of the orthopterids. Of Paleodictyopterids he describes but 3 forms. He believes that the greatest evolution of Paleozoic insects took place during the Westphalian, and states that at the top of the Lower Carboniferous (Dinan-

tian or Mississippian) but one order is known; early in the Westphalian three orders are "scarcely outlined"; and at the end of the Westphalian "almost all the Paleozoic phyla are fully established."

The evolution of insects was especially rapid at the base of the Westphalian (Flines member), again at the base of the upper part of the same series (Ernestine), and at the top of the Westphalian in the Edouard member. And this three-fold acceleration in insect evolution is in harmony with the floral enrichment.

We must add here that the supposed insects found in the Horton formation (early Mississippian) of New Brunswick, Canada, and mentioned in the table opposite page 293, have been shown to Professor H. F. Wickham and Dr. David White, with the result that both paleontologist and paleobotanist agree that they are not insects but the carbonized fragments of woody plants.

To the young author, a favorite student of Professor Barrois under whose direction are being carried out a series of studies designed to apply the "paleontologic method" to the problems of the coal basin of northern France, are extended our congratulations on his great achievement.

CHARLES SCHUCHERT

SPECIAL ARTICLES

THE RELATIVITY SHIFT OF SPECTRUM LINES

THREE experimental tests of Einstein's Relativity Theory of Gravitation have been proposed. Two seem to have been verified experimentally. The third, the predicted shift of solar spectrum lines, is still very much in dispute. Evershed and Royds,¹ and Schwarzschild² obtained very discordant results. St. John,³ with very fine apparatus, also obtained very discordant results with however a zero effect, on the average. Grebe and Bachem⁴ at first obtained discordant results, but a more careful analysis of their

¹ Bulletin 39, Kodaikanal Observatory.

² *Sitzungsberichte*, Berlin Akad., p. 1201, 1914.

³ *Astro. Jour.*, 46, 249, 1917.

⁴ *Verh. d. D. Phys. Ges.*, 21, 454, 1919.